

of Christianity not worth his notice; but tell him there is a ladder between the highest summit of the Himalaya and the Heavens, on which there are Munis and Rishis going up and down all the day long, and he will say "that's *worth* believing!" Belonging to that school which can see nothing satisfactory in a theory so elastic that no human argument can cover it, and nothing so contemptible, in a scientific point of view, as the habit of hastily theorizing, I have not much sympathy with those who are always ready with a cause and explanation for every thing. When facts are discovered, they can be told in a few words; and the most palpable only should be credited with a deduction like that of the "dawn of life."

LVII.—*Contributions to the Study of the chief Generic Types of the Palæozoic Corals.* By JAMES THOMSON, F.G.S., and H. ALLEYNE NICHOLSON, M.D., D.Sc., F.R.S.E., Professor of Natural History in the University of St. Andrews.

[Continued from p. 309.]

[Plate XII.]

#### Genus AMPLEXUS.

*Amplexus*, Sowerby, Mineral Conchology, vol. i. p. 165.

*Gen. char.* Corallum simple, subcylindrical or cylindro-conical, tapering towards the base, frequently tall, and more or less twisted. The epitheca is thin, with encircling lines of growth; and accretion-ridges are usually more or less conspicuously developed. Septa delicate and very short, never reaching to near the centre of the calice. Tabulæ exceedingly well developed, extending completely across the visceral chamber, and invariably exposed over a wide central area, into which the septa do not penetrate. A septal fossula is present, which is usually formed by a slight lateral depression of the tabulæ. Calice circular, moderately deep, with a thin margin.

The nearest ally of *Amplexus* has generally been assumed to be *Zaphrentis*; and there is doubtless a close alliance between the two. Typical examples of the former, however, are very readily and completely separated from characteristic species of the latter genus by the much more rudimentary condition of the septa and the nature of the septal fossula.

Upon the whole, therefore these two genera are marked off from one another by characters of a more fundamental and recognizable nature than those which separate *Zaphrentis* from *Cyathophyllum*.

The external form of the corallum in *Amplexus* is characteristically cylindrical, though this, of course, cannot be said to be distinctive of this genus. In addition, the corallum is very commonly tortuous, often of very unequal thickness in different parts, and frequently of great length as compared with its diameter. The accretion-ridges are sometimes very marked, at other times not so much so; and the epitheca is thin, and occasionally (as in *A. nodulosus*, Phill., Pl. XII. fig. 2) marked with hollow spinulose or nodular outgrowths.

The septa afford one of the most striking of the generic characters, being invariably very short and, comparatively speaking, rudimentary. This is well seen in transverse sections of *Amplexus coralloides*, Sow., and *A. nodulosus*, Phill. (Pl. XII. figs. 1 & 2). They differ in their length; but in no species of the genus do they ever extend further inwards towards the centre of the visceral chamber than, perhaps, about a third of the total diameter of the corallum, whilst in most species they are much shorter than this. In typical species, as in *A. coralloides* (Pl. XII. fig. 1), no secondary septa are developed; and there may or may not be interseptal dissepiments, whilst these, when present, are always comparatively simple and few in number.

The tabulæ are very well developed, and are usually bent in a more or less marked manner at their outer extremities (see the longitudinal section of *A. coralloides*, Pl. XII. fig. 1B). Owing to the rudimentary condition of the septa, there is invariably a space in the centre of the corallum which is occupied exclusively by the tabulæ. This central space, in which the tabulæ alone are exposed to view, varies from about a third to three fifths or more of the total area included within the wall of the corallum; and in no case which has come under our observation are the septa continued over the bare and smooth upper surfaces of the tabulæ. The distance of the tabulæ from one another is variable; but they usually extend completely across the visceral chamber, unless they be much crowded, in which case they may sometimes coalesce (see longitudinal sections of *A. coralloides*, fig. 1B, and *A. nodulosus*, fig. 3A). The tabulæ are approximately flat in the central area of the corallum; and the fossula, when recognizable at all, seems to be formed by a depression in the tabulæ, which is occupied by a septum of smaller length than the others. This is the case, at any rate, with *Amplexus coralloides*, though

we are not prepared to assert positively that this character is distinctive of the genus.

The calice is approximately circular in form, with a thin upper margin, and of moderate depth. Owing to the shortness of the septa, the bottom of the calice is nearly flat, and is formed by the upper surface of the first tabula.

Upon the whole the genus *Amplexus* must be regarded as a very distinct one, the type of which is found in *A. coralloides*, Sow., of the Carboniferous. The earliest examples of the genus with which we are acquainted appear in the Upper Silurian; and the group undergoes a considerable development in the Devonian, where it is represented by such typical forms as *A. Yandelli*, Edw. & H., and *A. tortuosus*, Phill. It is, however, in the Lower Carboniferous that the headquarters of the genus is found, and where it obtains its greatest development both as regards the number of species and the size of individual examples.

#### Genus ZAPHRENTIS.

*Zaphrentis*, Rafinesque and Clifford, Ann. des Sci. Phys. de Bruxelles, vol. v. p. 234.

*Gen. char.* Corallum simple, turbinate, conical or cylindro-conical, usually more or less curved. Calice deep, with a large and conspicuous fossula, the position of which is variable, but which is seen on transverse section to be formed by the coalescence of a portion of the septa, which fold round and form its walls. Septa well developed, extending nearly or quite to the centre of the visceral chamber. No columella is developed. The tabulae, though varying in their development, are always a conspicuous feature; and the septa are prolonged over their upper surfaces. The interseptal loculi are usually filled up towards the circumference of the corallum by convex dissepiments; but these are generally more or less remote and irregular, and the tabulae are continued through them to the wall.

The general form of the corals belonging to *Zaphrentis* is turbinate or trochoid; but they sometimes assume a more or less cylindrical form, and may attain a very great size. Other species, again, are singularly small in point of size. The epitheca is thin, and is usually marked with fine encircling striae, whilst accretion-ridges are not uncommonly present. The calice is deep, with attenuated margins; and there is always a large and deep fossula. The position of the fossula varies, being sometimes on the convex or dorsal side of the corallum, sometimes lateral, and commonly on the concave or

ventral side. Generally speaking, there is only a single fossula; but sometimes there are subordinate depressions, which appear to be of the same nature, though these have not been as yet sufficiently investigated. The most characteristic feature about the fossula, however, is the fact that it is formed by the coalescence of a greater or less number of the septa, which unite with one another towards the centre of the visceral chamber and form the walls of the fossule (Pl. XII, figs. 5 & 6).

The mode of formation of the fossula is thus entirely different in *Zaphrentis* from what obtains in *Amplexus*. We are not aware that this peculiarity has been noticed before; but all transverse sections exhibit it, and we believe it to be a character of primary importance in the definition of the genus.

The septa in *Zaphrentis* are differently developed in different species—but are usually remarkably thick towards the margins of the corallum, and become attenuated as they approach the centre of the visceral chamber. Indeed in some forms the septa are so much thickened towards the periphery, that they coalesce at their outer margins, and form a thick false wall. They also differ as to their extension inwards. Sometimes they reach quite to the centre of the visceral chamber; but at other times they fall short of this, and leave a small central area occupied solely by the tabulæ. In silicified specimens, however, the septa can often be traced on the upper surfaces of the tabulæ as far as the centre of the corallum (see Pl. XII, fig. 6, *Zaph. patula*). Small secondary septa are usually developed, one between each pair of primary septa; but they do not appear to be universally present. According to Milne-Edwards and Haime, the free edges of the septa are denticulate, as they project into the calice. This peculiarity, however, so characteristic of the genus *Heliophyllum*, we have not been able to recognize in any of the species of *Zaphrentis* which have come under our notice. The development of the interseptal dissepiments also seems to vary in different species of the genus. In some of the Devonian species these structures do not appear to exist at all; and in others they are but sparsely produced. Delicate curved dissepiments, however, with the convexity upwards, are commonly developed towards the circumference of the corallum; but in no case, are the dissepiments developed to such an extent as altogether to obliterate the tabulæ or to form a distinct external vesicular area. This latter structure is not found in any true *Zaphrentis*; and we shall hereafter show that the so-called *Z. cylindrica* of the Carboniferous, in the structure of which an outer zone of vesicular tissue is a conspicuous feature, is truly referable to the genus *Cyathophyllum*.

The tabulæ of *Zaphrentis* are usually remarkably well developed, and generally extend right across the entire space occupied by the visceral chamber, from side to side. They very commonly also exhibit a very conspicuous downward curvature near the circumference of the corallum. At other times they become more or less completely blended externally with the dissepiments, which then show a similar downward bending.

Upon the whole, the genus *Zaphrentis*, as restricted by us, may be readily recognized by the complete, or comparatively complete, development of the septal system, the great development of the tabulæ, the existence of a fossula, which is formed by the coalescence centrally of a certain number of the septa, and the fact that the dissepiments are in no case sufficiently developed to form an exterior zone of vesicular tissue. Additional characters of more or less importance are to be derived from the characters of the septa, the downward curvature of the tabulæ at the outer margins of the corallum, and the total absence of a columella.

The genus seems to make its first appearance in the Lower Silurian, though much has yet to be done before we can speak positively as to the affinities of some of these ancient forms. It is well represented in the Upper Silurian, and may be considered as attaining its maximum in the succeeding period of the Devonian. It is also largely represented in the Carboniferous period, after which it appears to have died out. *Z. patula*, Mich., and *Z. Enniskilleni*, Edw. & H., may be taken as exhibiting the typical structure of this genus in its greatest perfection.

In the Carboniferous deposits of Scotland, the species of *Zaphrentis* appear to attain their greatest development in the earlier portion of the Mountain-Limestone series. In the upper portions of the same series they appear to be already approaching extinction, and are usually much dwarfed and stunted in growth.

#### EXPLANATION OF PLATE XII.

- Fig. 1.* *Amplexus coralloides*, Sow. ; 1 A, transverse section of the same ; 1 B, longitudinal section of the same.  
*Fig. 2.* *Amplexus nodulosus*, Phill. ; 2 A, transverse section of the same.  
*Fig. 3.* Transverse section of another individual of the same ; 3 A, longitudinal section of the same.  
*Fig. 4.* *Amplexus*, sp. ; 4 A, transverse section of the same, cut somewhat obliquely ; 4 B, longitudinal section of the same.  
*Fig. 5.* Transverse section of *Zaphrentis Enniskilleni*, E. & H. The section is cut above the floor of the calice, and consequently shows no interseptal dissepiments.

- Figs. 5 A-5 D.* Transverse sections of the same specimen, showing the arrangement of the septa at different stages of growth.
- Figs. 6-6 C.* Transverse section of *Zaphrentis patula*, Mich., at different points, showing the dissepiments, secondary septa, and mode of formation of the fossula.
- Fig. 7.* Transverse section of *Zaphrentis Guerangeri*, E. & H., showing how the fossula is formed by the folding and coalescence of a certain number of the septa; 7 A, longitudinal section of the same, showing the arrangement of the tabulae.

[To be continued.]

LVIII.—*On the Bower-birds of Australia, with the Description of a new Species.* By JOHN GOULD, F.R.S.

OF all the acts performed by birds, that of building themselves beautiful bowers, variously decorated with shells, bleached bones, glittering stones, and gaudily coloured feathers, must ever be ranked amongst the most interesting traits in connexion with ornithology. At present the only known country in which these playing-places or halls of assembly are constructed is Australia. Whoever may have the good fortune to lift up the curtain which separates New Guinea from other countries, may probably find others.

*Chlamydodera occipitalis*, n. sp.

In size a trifle larger than *C. maculata*, and in its general aspect and spotted upper surface very similar; and, like that, the present new bird has the usual occipital mark of lilac feathers, except that it is twice as large and more beautiful in colour, especially when seen from beneath. I have for many years had two females in my collection, which differ from the females of *C. nuchalis*, so common on the river-banks of Mokai Guyder and other parts of the interior of New South Wales; but it is only lately that I have received the male. That I ought to be an authority on the different species of the Bower-birds is evidenced by my having lived among them, studied their habits, and given double-sized plates of the bowers of two of the species in my folio edition; but never in all my encounters with the *Chlamydodera maculata* (and they were many) have I seen any thing like the bird under consideration. In giving North Queensland as the habitat of this species, it must be taken in a general sense; for the precise locality is unknown to me; and I await fresh information with interest and anxiety.